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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Metering Valve

We, KABUSHIKIKAISHA KEIHINSEIKISEISAKUSHO, a Japanese Corporation, of No. 407, Iohinotsubo, Kawasaki-shi, Japan, do hereby declare the invention for which we pray that a Patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates generally to metering valves for controlling the flow of fluid through a pipe line which varies greatly in pressure.

Various and considerable efforts have been directed to realize efficient and sensitive metering valves, capable of controlling the outlet or delivery flow rate of the fluid under control regardless of fluctuation of the inlet pressure thereof.

According to the conventional technique, however, considerable deviation must be encountered for attaining and maintaining the desired constant flow rate in known metering valves. The main reason for this is the non-linear flow through the valve which, not only reduces the flow efficiency of the valve, but also delicately influences the control performance to a substantial degree.

The main object of the present invention is therefore to provide a metering valve, capable of providing a substantially constant flow rate at the outlet thereof, regardless of possible fluctuation of the inlet pressure, with a highly improved efficiency, under a considerably stabilized operating condition and with simpler design of the valve.

The foregoing and further objects, features and advantages of the invention will become more clear as the description proceeds by reference to the accompanying drawings illustrative substantially of a preferred embodiment of the invention, by way of example, and thus in no limiting sense thereof.

In the drawing:

Fig. 1 is a longitudinal section of a preferred embodiment of the metering valve embodying the principles of the invention.

Fig. 2 is an exploded perspective view of the inner constituent parts of the valve shown in Fig. 1.

Fig. 3 is a diagram wherein the opening area at the throttle zone of a metering valve embodying the principles of the invention has been plotted against occasional and various pressure differences appearing between the inlet and the outlet of the valve.

Fig. 4 is a diagram illustrating the flow rate as expressed in percentage of the designed constant flow rate and plotted against occasional and various pressure differences appearing between the inlet and the outlet of a metering valve embodying the principles of the invention.

Now referring to the accompanying drawings, especially Figs 1 and 2 thereof, a preferred embodiment of the present invention will be described in detail hereinbelow:

In the drawing, 10 denotes a valve housing, preferably made of cast iron or steel and comprising a substantially cylindrical hollow main body 11 and fixing flanges 12 and 13, said housing being inserted in a pipe line for conveying any kind of fluid such as water or the like. In Fig. 1, the direction of the fluid flow is shown by an arrow X. Valve housing 10 is formed concentrically with an axial flow passage 14 bored therethrough and having inlet 14a and outlet 14b. Leading part and trailing part of the pipe line kept in fluid communication with said inlet 14a and outlet 14b, respectively, is represented by chain-dotted line 15 and 16 in schematic manner.

In the wall of flow passage 14, there is a peripheral groove 17 in proximity of the

Q . . .	flow rate of the fluid under treatment cm ³ /sec.
A ₁ ; A ₂ . . .	opening areas, cm ² , of the orifice under first and second operating conditions
h ₁ ; h ₂ . . .	pressure read differentials, cm, under first and second operating conditions.
C ₁ ; C ₂ . . .	non-dimensional constants under first and second operating conditions.
g	gravity constant, 980 cm/sec/sec.

10 Then,

$$A_2 = A_1 \frac{C_1 \sqrt{2gh_1}}{C_2 \sqrt{2gh_2}} \quad \dots (1)$$

When considering the values C₁; C₂; A₁; h₁ be specific constants for the initial conditions, and representing them as a whole by a single constant C, the formula (1) will become:

$$A_2 = \frac{C}{h_2} \quad \dots (2)$$

When this relation is plotted on a chart, a similar curve as shown in Fig. 3 may be found

20 When observing the curve shown in Fig. 3 it can be seen that the necessary variation in the opening area for lower pressure differential is considerably predominant relative to that required for higher pressure differential. In the first embodiment shown in Figs. 1 and 2, one of the two springs, preferably the second spring 23, is selected to be considerably weaker than the other, preferably the first spring 21 so as to meet the aforementioned operating conditions with lower pressure differentials. Only after the second weaker spring has been considerably deflected, the first spring will respond to higher pressure differentials, so as to meet the aforementioned operating requirements, although in the foregoing the strengths of these both springs have been assumed, only for simplicity of description, to be equal to each other. This critical point is that when the intermediate slide 22 has been brought into engagement with the disk 24a.

Even when using the simplified modification employing a single spring, however, the requirements can be substantially met as

shown the dotted line performance curve in Fig. 4.

WHAT WE CLAIM IS:—

1. A metering valve for fluid flow control, comprising a valve casing having a fluid flow passage formed therein and defined by its inlet and outlet ends, a valve member mounted within said flow passage and slidable from a predetermined initial position in the downstream direction upon being subjected to a pressure differential appearing between said inlet and outlet ends, and spring means urging said valve member towards its initial position, in which said passage is substantially linear and said valve member comprises a hollow piston co-operating with a stationary needle means, said piston being positioned slidably in the proximity of said inlet end said needle means comprising a needle member arranged with its longitudinal axis along the axis of said flow passage and a perforated disk rigidly attached to the downstream end of said needle member and positioned at a predetermined position downstream in said flow passage relative to said piston, said needle member and said piston establishing a variable throttle zone therebetween.

2. A metering valve as set forth in Claim 1, in which an intermediate hollow slide is mounted between said piston and said disk and said spring means is divided into two spring parts, one of which is inserted between said piston and said intermediate slide and the other of which is inserted between said slide and said disk, one of the spring parts being weaker than the other.

3. A metering valve for fluid flow control, substantially as hereinbefore described and illustrated with reference to the accompanying drawings.

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FIG. 1.

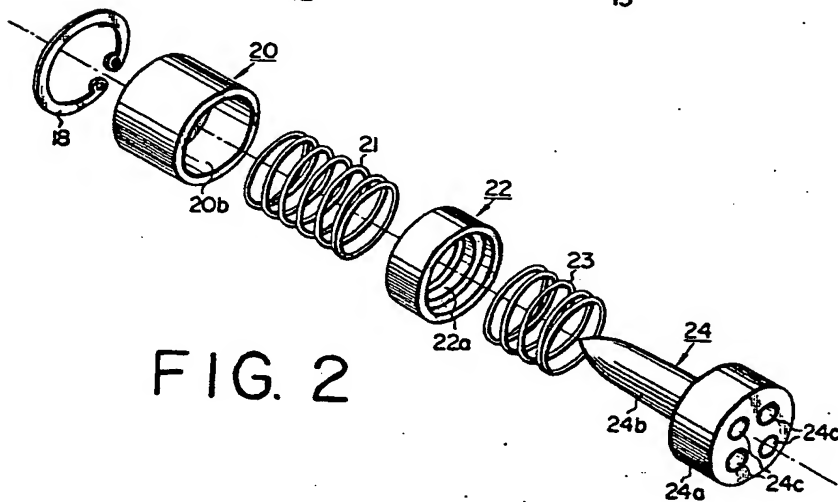
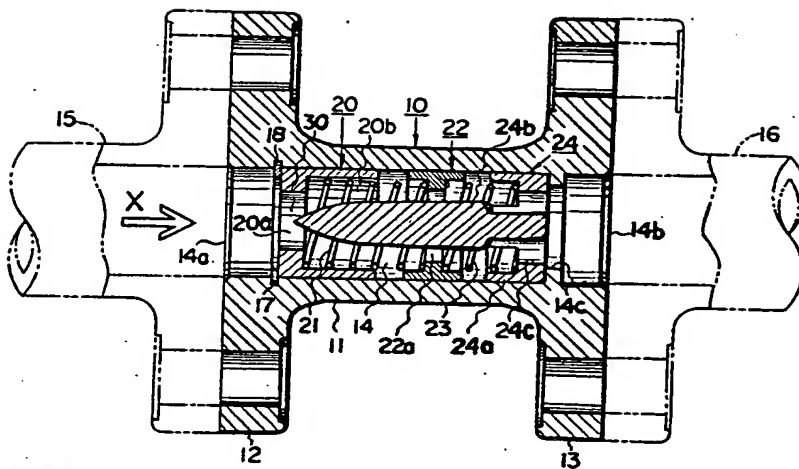


FIG. 3

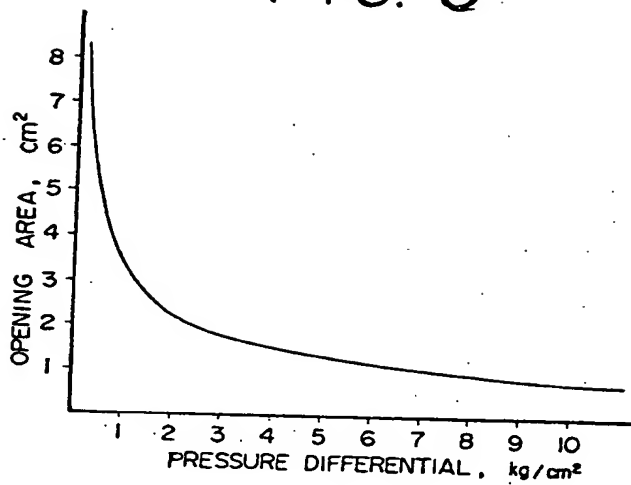


FIG. 4

